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XXI.—*Notes on the Palæozoic Bivalved Entomostraca.* No. IV.  
*Some North American Species.* By T. RUPERT JONES, F.G.S.

[With two Plates.]

[Continued from 2nd Series, vol. xvii. p. 101.]

THE Entomostraca which I propose to describe in this communication have been brought from different parts of North America at different times, and kindly submitted to me for examination. The series of specimens from Canada were placed in my hands, in 1851, by Sir W. E. Logan; and I intended to describe them at once, but found that, without a more definite knowledge of the *Beyrichiæ* and allied forms already noticed by geologists, I could not do justice to the work. The Notes I., II., & III., on Palæozoic Bivalved Entomostraca, published in former volumes of the 'Annals,' have been the result of my inquiries on this subject; and at last I felt more capable of handling the series set before me. In the meantime, other North American materials came to hand. A portion of these specimens have taken their place as illustrative of generic characters in the former papers; and a portion remain to be noticed here, including the smaller Entomostraca in the limestone of Beechey Island, a few specimens from the United States in the Geological Society's Museum, and, more especially, a valuable series of beautiful specimens from Pennsylvania, which Prof. H. D. Rogers has most considerately and kindly permitted me to describe as illustrative fossils of the Geological Survey of that State.

Several species of bivalved Entomostraca have been already  
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noticed by the geologists of the United States; and some of these I believe I have satisfactorily recognized in specimens at my command; about some of the others I am still in much doubt; and some I have not as yet seen.

I proceed to describe the species: first, those from Beechey Island; 2ndly, those from Canada; 3rdly, those from the United States.

(From Beechey Island.)

1. *Beyrichia rugulifera*, spec. nov. Pl. IX. fig. 4.

Length  $\frac{1}{20}$ , breadth  $\frac{1}{40}$  inch.

A "simple" or unisulcate *Beyrichia*; nearly oblong, narrow; extremities nearly equal; ventral margin faintly convex; dorsal notch broad and deep. Surface of valves ornamented with a delicate sculpturing of irregular, interrupted, somewhat sinuous, tapering, little grooves, arranged vertically (transverse to the long axis of the valve), appearing like a system of minute wrinkles.

From Beechey Island, in the limestone containing *Leperditia gibbera*. (See Annals Nat. Hist.\* 2nd ser. vol. xvii. p. 91.)

2. *Beyrichia sigillata*, spec. nov. Pl. IX. fig. 5.

Length  $\frac{1}{20}$ , breadth  $\frac{1}{32}$  inch.

Unisulcate, ovato-oblong, ends and belly well rounded, and margined by a broad, uniform, depressed rim; dorsal notch distinct, narrow. Surface of valves marked with numerous distinct, irregularly oval pits.

Beechey Island, with the foregoing.

3. *Beyrichia clathrata*, spec. nov. Pl. IX. fig. 1.

Length  $\frac{1}{16}$ , breadth  $\frac{1}{26}$  inch.

A bisulcate form; the surface of the valve presenting a large horseshoe-shaped lobe, and a small, rounded, subcentral lobe; the latter being limited and almost surrounded by the two dorsal notches. Anterior portion of the valve somewhat puckered vertically,—a feature which is carried to an extreme in the next species, *B. plagosa*. Surface of the valves ornamented by a bold pattern of broad, shallow, subangular pits, having a somewhat radiate arrangement as regards the centre of the valve.

From Beechey Island, with the foregoing.

\* I omitted to mention that the right valve figured in Pl. 7. fig. 8, was brought from Beechey Island by Dr. Armstrong, among other fossils.

This species much resembles some varieties of *B. Klædeni* (Annals Nat. Hist. 2 ser. vol. xvi. p. 166), in which the fore and hind lobes are continuous, or nearly so, along the ventral part of the valve. In *B. clathrata*, however, and in *B. plagosa*\*, there is no interruption of the ventral lobe at all, which has a great relative breadth, like that in *B. Wilckensiana*, the type of the "Corrugatæ," or bisulcate group of *Beyrichiæ* (Annals Nat. Hist. 2 ser. vol. xvi. p. 85).

In *B. Klædeni*, as in *B. tuberculata*, the ornamentation takes a granulate form; in the *Beyrichiæ* from Beechey Island, on the contrary, it is in intaglio.

#### 4. *Beyrichia plagosa*, spec. nov. Pl. IX. fig. 2.

Length  $\frac{1}{16}$ , breadth  $\frac{1}{26}$  inch.

This belongs also to the bisulcate type, and has a large semi-circular, and a small, oval, subcentral lobe; but the former is traversed along its length by several more or less parallel and concentric, but irregular, sunken lines, dividing the lobe into about four large and six small convex stripes, of unequal proportions.

The whole surface is impressed by a system of minute channels, coarsely reticulate.

From Beechey Island, with the foregoing.

The *Beyrichiæ* from Beechey Island occur in considerable numbers, in company with *Leperditia gibbera* (Annals Nat. Hist. 2 ser. vol. xvii. p. 90), in a small piece of dark-coloured limestone brought to England by Capt. Sir E. Belcher. Like the *L. gibbera*, all the *Beyrichiæ* in this rock retain their shells, which exhibit a glossy surface and a brown colour.

For a *Cytheropsis* from Beechey Island, see p. 254.

\* These two species were referred to, as being probably two varieties of *B. Klædeni*, in Annals Nat. Hist. 2 ser. vol. vi. p. 91, but a careful examination has led me to regard them as certainly distinct from that species. With respect to their difference one from another,—although they have much in common as to their outline and general form,—though the ornament of *B. clathrata* may be the rudimentary state of the reticulation of *B. plagosa*, and though the plating of the latter is, as it were, begun in the anterior lobe of *B. clathrata*, yet, in accordance with the plan which we must adopt with fossil remains in which evidences of the soft parts are wanting, and which we are desirous of rendering useful palæontological witnesses of former races, I have given full weight to the differences of structure, and regarded these two *Beyrichiæ* as species and not varieties.

(From Canada.)

1. *Beyrichia Logani*\*, spec. nov. Pl. IX. figs. 6-10.Length  $\frac{1}{16}$ , breadth  $\frac{1}{26}$  inch.

This is a small *Beyrichia* of the unisulcate group ("Simplices," Annals Nat. Hist. 2 ser. vol. xvi. p. 85); variable in shape, from reniform to oblong; dorsal edge straight, extremities rounded and almost equal; ventral edge varying in its convexity. Surface of the valves somewhat depressed, most convex a little above the median line, sloping more gently to the ventral than to the dorsal margin; usually punctate, sometimes smooth; always bearing a distinct narrow depression on the dorsal region, usually on its anterior third; this dorsal notch reaches across a third or even more of the breadth of each valve. Ventral and terminal margins bordered by a narrow depressed rim.

I cannot regard the extreme shapes of the gregarious and innumerable individuals of this *Beyrichia* as typical of specific distinction. The general form, the relative convexity, and the dorsal notch are the more characteristic features.

*a.* Var. *reniformis*. The extreme of the kidney-shaped form is well shown in fig. 6, a specimen from Hawkesbury, occurring with others like it, with many of oblong outline, and some of intermediate shapes. The specimen here figured is strongly punctate: smooth specimens of this variety occur at Grenville.

*b.* Var. *leperditioides*. In fig. 10 we have one of the specimens in which the antero- and postero-dorsal corners of the valves become modified towards the well-marked oblique dorsal angles of *Leperditia* †.

*Localities.* Grenville and Hawkesbury; in the "two-foot limestone," in the upper part of the Calciferous Sandrock (see further on, p. 245).

2. *Leperditia Canadensis* ‡, spec. nov. Pl. IX. figs. 11-15.Length  $\frac{1}{9}$ , breadth  $\frac{1}{13}$  inch.

Small; somewhat variable in shape, but always retaining the characteristic *Leperditia*-outline, with straight back, more or less obliquely-rounded belly, and sloping dorsal angles. Carapace usually short (the height or breadth being about two-thirds of the length), somewhat variable in the amount of convexity

\* Referred to in Quart. Journ. Geol. Soc. vol. viii. p. 207.

† See p. 247 for further remarks on *B. Logani* and its varieties, in relation to *L. Canadensis*.

‡ Referred to in Quart. Journ. Geol. Soc. vol. viii. p. 202 &amp; p. 207.

(thickness), which is usually greatest at the antero-ventral third. Surface smooth. Eye-tubercle generally well marked, and muscle-spot often distinct; but occasionally the latter becomes involved in the nuchal depression, and the former is sometimes obsolete.

This is the smallest form of *Leperditia* which I have yet met with. It occurs in great numbers, together with *Beyrichia Logani* in equal abundance, in a dark-grey friable limestone, mainly composed of these Entomostraca, fragments of Trilobites, and shells, at Grenville and near Hamiltonville in Hawkesbury, on the Ottawa. This *Leperditia*-limestone forms part of a band of limestone, about 2 feet thick, which extends over a wide district\*, and is of importance as marking the position of a continuous band of concretionary phosphatic rock which is beneath it, and belongs either to the base of the Chazy limestone†, or the summit of the Calciferous Sandrock‡.

*L. Canadensis* occurs also in a dark-grey, crystalline, shelly limestone (of the Calciferous Sandrock) at Grande Isle § (north side), in the St. Lawrence. In two hand-specimens of this limestone a few separate valves and one pair of valves are present.

a. *Var. labrosa*. Pl. IX. fig. 13.

Length  $\frac{1}{8}$ , breadth  $\frac{1}{10}$  inch.

The extremities of the valves are in this specimen from Hawkesbury marked by a broad marginal depression, which is continued less strongly along the ventral border; and the antero-dorsal corner is more produced than usual.

This may be an individual modified by accidental circumstances of growth.

b. (*Leperditia Canadensis*? Pl. IX. figs. 16, 17.)

Specimens of possibly the same species as the foregoing, but of a considerably larger size (often twice as large), occur in two other limestones, specimens of which Sir W. Logan has confided to my care.

Imbedded in bits of black fine-grained limestone from Louck's

\* "This rock, having been quarried for lime-burning in several places, has been followed from Carillon to Grenville (thirteen miles)." Quart. Journ. Geol. Soc. vol. viii. p. 207; and Logan's Report Geol. Surv. Canada, 1851-52, p. 18.

† The *Atrypa plena*, which is characteristic of the base of the Chazy limestone, appears to occur above the *Leperditia*-bed.

‡ Esquisse géologique du Canada, par W. E. Logan et T. S. Hunt, p. 42.

§ Quart. Journ. Geol. Soc. vol. viii. p. 202; and Logan's Report, 1851-52, p. 15.

Mill, on the Castor River (Russell Township), are three glossy black valves, in good preservation, and of different sizes (one specimen being  $\frac{3}{10}$  in. long and  $\frac{2}{10}$  broad; the others being respectively  $\frac{3}{20}$  in. and  $\frac{3}{40}$  in. in length). In each of these the eye-spot is very distinct, and accompanied by a local ruggedness of the surface of the valve (not amounting to a sulcus), and the valves are faintly rimmed.

This black limestone is referred to the "Trenton" in 'Geol. Surv. Canada Report,' 1851-52, p. 73; but, according to a letter of later date from Sir W. E. Logan, it may be "Birdseye limestone."

A small specimen of brownish, fine-grained limestone (weathering grey, and containing shells), from Pauquette's Rapids, Allumette Island, Ottawa River, contains one well-preserved brown-coloured valve (fig. 17),  $\frac{1}{4}$  inch long,  $\frac{3}{20}$  inch broad, much like the largest specimen from Louck's Mill, but showing no marginal rim, and feeble traces only of the eye-spot and its accompanying depression. In this fragment of (probably Trenton) limestone smaller Entomostracous bivalves abound (see p. 249).

Excepting in the relative size, the form of the eye-spot, and the valve-margin (in which latter points one of these larger specimens varies from the others), the two sets of specimens (the large and the small) do not appear to disagree essentially, as far as my means of examination at present enable me to judge. At the same time, as we know that, in some recent bivalved Entomostraca, different species and even subgenera may present a great similarity in their carapaces, it is possible that we have here a separate specific form.

Mr. Conrad has briefly described\*, under the name of "*Cytherina fabulites*," a bivalved Entomostracan, from the Trenton limestone of Mineral Point, Wisconsin. This appears to be a *Leperditia* half an inch in length, and therefore surpassing in size the specimens under notice, to which it may be allied.

Other localities in Canada are mentioned by Sir W. E. Logan and Mr. Murray for Entomostraca—probably *L. Canadensis* or allied forms: namely:—

Three miles above Lachine; in the Trenton limestone? †.

Indian Lorette near Quebec; in the Birdseye limestone? ‡.

"Three or four miles from Montreal city, in a line a little west of north; in Birdseye limestone §."

\* Proceed. Philad. Acad. vol. i. p. 332.

† Quart. Journ. Geol. Soc. vol. viii. p. 205.

‡ Letter, Jan. 17, 1853.

§ Letter.

Sheik's Island, Cornwall, on the St. Lawrence\* ; with *Atrypa plena* (Chazy).

Cornwall ; in the Trenton limestone †.

Lancaster ; in the Black River limestone ‡.

Winchester ; in the Trenton limestone §.

*Beyrichia Logani* and *Leperditia Canadensis* occur together in immense numbers, forming indeed a considerable portion of the rock—a limestone, 1 foot 10 inches thick—in which they are chiefly found. I believe that the former is not the young of the latter (although, perhaps, the differences of shape and structure are not greater than such as we find to occur between the young and adult forms of recent Entomostraca and other Crustacea), because, where the allied *Beyrichiæ*, such as *B. strangulata* ||, *B. mundula*, and *B. simplex*, occur, even in equal numbers, in the rocks of other localities, the *Leperditia* are not found with them ; the latter also occurring unaccompanied by these *Beyrichiæ* ; and *L. Canadensis* itself being found isolated in Grande Isle. The close resemblance in outline of some specimens of *B. Logani* (var. *B. leperditioides*, fig. 10) to the *Leperditia* is, I believe, merely a mimetic resemblance of outline, such as we find taking place among many groups, both of the lower and the higher animals.

### 3. *Leperditia Anna* ¶, spec. nov. Pl. IX. fig. 18.

Length  $\frac{1}{6}$ , breadth  $\frac{1}{9}$  inch.

Small, convex ; ovate-oblong, somewhat narrower in front than behind ; the ventral curve nearly uniform ; hinge-line straight ; dorsal angles slightly truncate. Surface of valves most convex at the posterior third ; smooth, thickly punctate, each of the little shallow circular pits having a minute central tubercle. Eye-spot distinct and raised.

Several valves of this neatly-pitted *Leperditia* are present in a small hand-specimen of a hard, dark-coloured, concretionary limestone, under the zone of *Atrypa plena*, and belonging to the Calciferous Sandrock, from "immediately behind the village of St. Ann's\*\*," at the confluence of the Ottawa and St. Lawrence. This is probably the oldest known species of the genus.

\* Geol. Surv. Canada Report, 1851-52, p. 70.

† *Ibid.*

‡ *Ibid.* p. 71.

§ *Ibid.* p. 72.

|| *Beyrichia strangulata* takes on a variety of forms (see Annals Nat. Hist. vol. xvi. pl. 6. figs. 18-22) analogous to those of *B. Logani*.

¶ Referred to in Quart. Journ. Geol. Soc. vol. viii. p. 204.

\*\* Quart. Journ. Geol. Soc. *loc. cit.* ; and Geol. Surv. Canada, Report, 1851-52, p. 16.

ISOCHILINA\*. Subgenus of *Leperditia*.

Equivalve; the margins of the valves meeting uniformly, not overlapping as in *Leperditia*; greatest convexity of the valves either central or towards the anterior portion. Eye-tubercle present. Muscular spot not distinct externally.

4. *Leperditia (Isochilina) Ottawa*, spec. nov. Pl. X. fig. 1.

Length  $\frac{1}{6}$ , breadth  $\frac{1}{10}$  inch.

*Leperditia*-like in outline, somewhat elongate, smooth; marginal border distinct, frequently seen to be marked by a line of small, distinct pits; eye-spot distinctly raised.

From the Canal, Grenville. Gregarious; the separated valves forming a thin seam, about half an inch thick, in a dark-grey limestone in the Calciferous Sandrock, a foot or two beneath the "two-foot limestone," and traceable for some miles.

5. *Leperditia (Isochilina) gracilis* †, spec. nov. Pl. X. fig. 2.

Length  $\frac{1}{7}$ , breadth  $\frac{1}{12}$  inch.

Carapace subrhomboidal, narrow and slender compared with the *Leperditia* proper; anterior extremity obliquely rounded, with the antero-dorsal angle produced, slightly obtuse; posterior extremity rounded, with the postero-dorsal angle obliquely truncate. Ventral curve uniform. Surface of valve convex centrally, black, shining, smooth, sparsely punctate; the pitting partial, often obscure, or nearly obsolete. Depressed margin broad, in many specimens bearing a row of rounded pits (about 32), which are represented on the inside of the rim by corresponding raised obtuse points.

Gregarious, in loose fragments of a black, fine-grained, foetid limestone, from the White Horse Rapids (Isle Jesus), referred, with doubt, to the Trenton limestone in the Quart. Journ. Geol. Soc. vol. viii. p. 205, but to the Birdseye limestone in a letter of later date from Sir W. E. Logan. The disunited valves lie matted together, and sprinkled with minute iridescent crystals of pyrites, in a thin layer, or layers, in the rock.

## CYTHEROPSIS, genus, M'Coy.

This generic appellation is affixed to a bivalved Entomostracan (fig. 2. pl. 1 L) in the 'Systematic Description of the British Palæozoic Fossils in the Geological Museum of the University of Cambridge,' 1855, but neither the characters of the genus

\* *Equal-lip*: ἴσος, equal; χεῖλος, lip.

† Referred to in Quart. Journ. Geol. Soc. vol. viii. p. 205.



nor of the fossil are described, owing probably to the author not having had time to add this description to the great work referred to.

*Cytheropsis* appears to me to be a useful term for the distinction of those palaeozoic Entomostraca that do not closely assimilate either to *Leperditia* or *Beyrichia*, but much resemble in outline and size many of the *Cytheres* of the existing seas, differing however from them in sometimes having eye- or muscle-spots, and other peculiar features, such as a comparatively great thickness of the valves. Though based chiefly on negative characters, yet this group may for the present be conveniently referred to as being generic.

I have noticed several minute Entomostraca in the Silurian rocks of Wales and Sweden, which may probably belong to this group.

6. *Cytheropsis concinna*, spec. nov. Pl. X. figs. 3, 4.

Length  $\frac{1}{17}$ , breadth  $\frac{1}{33}$  inch.

Carapace subcylindrical, tapering anteriorly; ends rounded; back straight; dorsal angles slightly truncate; ventral edge of right valve overlapping that of the left. Surface smooth, shining, light-brown, partially pitted. In some specimens a very slight marginal rim is traceable.

Many specimens, both of double and single valves, in the Trenton (?) limestone of Pauquette's Rapids, Allumette Island, Ottawa River.

I have had some doubt whether this may not be the young of a *Leperditia*; but it has no eye-spot and is too narrow, young *Leperditia* being proportionally broader than the adults.

7. *Cytheropsis Siliqua*, spec. nov. Pl. X. fig. 6.

Length  $\frac{1}{12}$ , breadth  $\frac{1}{40}$  inch.

Carapace-valves long, narrow, pod-like or skiff-shaped; ends acute, one much sharper and more tapering than the other; dorsal edge long and straight; ventral edge convex; one valve overlapping the other. Smooth, shining, brown.

Two separate valves of this curious and rather obscure form (so much resembling *Bairdia Siliqua* of the Chalk, and the recent *B. Minna*) occurred in the limestone from Pauquette's Rapids.

8. *Cytheropsis rugosa*, spec. nov. Pl. X. fig. 5.

Length  $\frac{1}{30}$ , breadth  $\frac{1}{46}$  inch.

Small, convex, subreniform, broad, rounded at both ends,

one of which (anterior) is smaller than the other. Coarsely sculptured with broad shallow pits. One specimen, showing the two valves united, and of a light-brown colour, occurred with the many other Entomostraca in the small specimen of limestone from Pauquette's Rapids.

(From the United States.)

1. *Leperditia alta*, Conrad, sp. Pl. X. figs. 10, 11.

Annals Nat. Hist. 2 ser. vol. xvii. p. 88. pl. 7. figs. 6 & 7.

Numerous individuals of this species occur in the dark-coloured "Tentaculite-limestone"\* of Schoharie, accompanied by *Spirifer plicatus*. The specimens are mostly in an indifferent state of preservation; but here and there evidences of the smooth surface of the valves are obtained. In outline most of them resemble fig. 7a of Pl. 7 above referred to; but others are more tapering anteriorly, as in the figures now given (Pl. X. figs. 10 & 11).

I have now no doubt that the Arctic specimens before described belong to this species.

The "Tentaculite-limestone" of Schoharie belongs to the Lower Helderberg group of strata,—the "Premeridian" group of the classification adopted by the Professors Rogers.

2. *Leperditia gibbera*, Jones, Annals Nat. Hist. 2 ser. vol. xvii. p. 90. pl. 7. figs. 8-10.

Var. *scalaris*. Pl. X. figs. 7-9.

In the grey "Waterlime-rock" of Williamsville, specimens of which, collected by Sir C. Lyell, are now in the Geological Society's Museum, are some casts of a fine *Leperditia* (one specimen being  $\frac{1}{2}$  inch long and  $\frac{3}{10}$  inch broad, with others smaller and of different sizes) which has the general aspect of *L. gibbera* of the Silurian limestone of Beechey Island, but is larger and less convex, and has a much smaller hump on the dorsal region of the left valve.

In the black limestone (weathering grey) of the "Scalent group" (Rogers),—of about the same age as the "Waterlime" of Williamsville,—there also occur specimens of a similar form. These are in a beautiful state of preservation, exhibiting glossy black valves. The left valve bears a distinct, but small, dorsal

\* In the collection of Silurian fossils brought by Sir C. Lyell from North America, and now in the Museum of the Geological Society of London, are several specimens of this *Leperditia*-limestone.

hump; the right valve is without it; and the surface of both is smooth and unornamented, except that the muscle-spot is seen under a lens to be neatly and faintly reticulated, but apparently unaccompanied with radiated vascular markings (figs. 8 & 9).

These specimens vary much in size. There is a fragment of an individual which was larger than even the largest of the specimens from the grey limestone of Williamsville. On the other hand, there is a single left valve only  $\frac{1}{8}$  inch long,—probably of a young individual: this is broader in proportion to its length than the larger individuals, being ovate in outline, and presents no dorsal hump, which, from this, would appear to be acquired in the adult state only.

The differences between *L. gibbera* of the Arctic limestone and these specimens from the United States are—the absence of pittings on the surfaces of the latter, and the smallness of the dorsal hump of their left valve. There are also larger individuals among these more southern specimens; but, as the number of the Arctic specimens was very limited, the exact relative size cannot be regarded as fairly ascertained. From the above considerations, I regard the specimen under notice as belonging to a variety of *L. gibbera*.

A thin seam of hard grey limestone, half an inch thick, on a rather higher horizon than that of the black limestone just referred to, has its surfaces thickly beset with badly preserved valves of a *Leperditia*, apparently of the same variety as the last-described.

### 3. *Leperditia Pennsylvanica*, spec. nov. Pl. X. figs. 12, 13.

Length  $\frac{6}{10}$ , breadth  $\frac{7}{20}$  inch.

Valves very convex, mostly at the middle and somewhat anteriorly; the posterior half of the valve sloping more gradually, and broader, than the anterior, and rounded; dorsal margin straight and long.

This species is very near to *L. Balthica*\* of Europe and *L. Arctica*† of North America; but it is narrower and more convex; its eye-spot, which is very distinct, and placed on an angular escutcheon (as in *L. Arctica*), is rather nearer to the dorsal edge, and is accompanied by greater local unevenness of the surface, than in either *L. Balthica* or *L. Arctica*; and the substance of the valves is thinner than in these species.

A specimen of greyish limestone from near Barre Forge,

\* Annals Nat. Hist. 2 ser. vol. xvii. pl. 6. figs. 1-5.

† *Ibid.* pl. 7. figs. 1-5.

Pennsylvania, belonging to the "Surgent group," and of the same age as the "Clinton group\*," is full of individuals of this species. It exhibits numerous light-brown valves, of different sizes, and in good preservation, showing smooth, non-punctate surfaces, with the eye-spot and its escutcheon, and the muscle-spot with its reticulated surface and delicate sinuous radii passing downwards and backwards (fig. 12). *L. Pennsylvanica* is here accompanied by a few specimens of a minute *Beyrichia* (*B. Pennsylvanica*?).

In some fragments of another greyish limestone of the "Surgent group," we have numerous specimens, some well preserved, of this species; the valves are of a darker tint than in other instances, and somewhat more convex (fig. 13).

4. *Leperditia ovata*, spec. nov. Pl. X. fig. 14.

Length  $\frac{3}{10}$ , breadth  $\frac{2}{10}$  inch.

In a specimen of the Blackriver-limestone ("Auroral group") of Potter's Fort, Penn's Valley, Pennsylvania,—a bluish-grey crystalline limestone, containing Spirifers and Encrinites,—occurs a single right valve of a small *Leperditia*, black, smooth, unornamented, having a nearly ovate outline and a convexity sufficient to give a subglobose form to the closed carapace. The slightly raised muscle-spot marks the centre of the valve; but the eye-spot is wanting.

The want of angularity in this form, though it has a straight hinge-line, its central muscle-spot, and absence of ocular tubercle distinguish it from *L. Canadensis*, and offer sufficient characteristics to lead me to recognize it by the specific name of *L. ovata*.

The *Cytherina fabulites* of Mr. Conrad† appears, from the brief description given of it, to be somewhat allied to the species before us. Mr. Conrad's specimen is from the Trenton limestone of Mineral Point, Wisconsin.

5. *Beyrichia Maccoyiana*, Jones. Pl. X. fig. 15.

Annals Nat. Hist. 2 ser. vol. xvi. p. 97. pl. 5. fig. 14.

Numerous individual valves of this species, of a somewhat larger size than the Scandinavian specimens, and in fine preservation, occur in a flaky calcareous rock, almost wholly com-

\* For the classification of the Palæozoic Rocks of North America, see Prof. H. D. Rogers's Geological Map of the United States, in Keith Johnston's 'Physical Atlas;' also Prof. James Hall's works on the Geology and Palæontology of the State of New York.

† Philad. Acad. Nat. Sc. Proceed. vol. i. p. 332.

posed of *Beyrichia* (*B. Pennsylvanica*), from the limestone-bands of the marls of the Scalent series of Pennsylvania.

6. *Beyrichia Pennsylvanica*, spec. nov. Pl. X. figs. 16-18.

Length  $\frac{1}{24}$ , breadth  $\frac{1}{30}$  inch.

Carapace-valves small, varying from oblong to nearly reniform, convex, coarsely punctate or reticulate, and marked by two short dorsal notches, which are variable in their development. Sometimes the anterior notch is obsolete (see fig. 16),—probably a condition of the young state,—giving the valve a unisulcate appearance. Sometimes the two notches encircle a small roundish lobe (fig. 17); but usually they are distinct, and separated by the central lobe of the valve's surface (fig. 18). Many conditions intermediate to these occur.

In its one-notched state, this species much resembles *B. stragulata*, and in its fully-developed trilobed form it resembles some varieties of *B. Klædeni*, on the one hand, and *B. clathrata* of Beechey Island, on the other: but it is certainly distinct from either.

Innumerable individuals of this *Beyrichia*, of different stages of growth, are present in the limestone-bands in the marls of the Scalent group of Pennsylvania (Onondaga Salt group). Some of this hard calcareous rock, which is dark-grey internally, but weathers of a lighter and ferruginous grey, is almost composed of the *Beyrichia*, and is traversed by very fine parallel linear fissures, occupied by calc-spar.

The same species occurs in equal numbers, in company with *B. Maccoyiana*, in a somewhat similar rock of the same formation, but softer, more flaky, and not traversed by cleavage-lines.

I have found two individuals of apparently a smooth variety of this species, showing the three lobes, as in fig. 18, in the greyish limestone from near Barre Forge, where it is associated with *Leperditia Pennsylvanica*.

7. *Leperditia (Isochilina) cylindrica* (?), Hall, Palæontology of New York, vol. ii. p. 14. pl. 4. fig. 8.

Under the name of "*Cytherina cylindrica*," Prof. James Hall has noticed and figured some Entomostraca in the "Medina Sandstone" of Orleans County; and though these figures and description are of little service in the identification of the species, yet, having examined some apparently similar specimens also in Medina sandstone, I offer some remarks on the subject, espe-

cially as it appears to me that we have here an interesting zoological link between the faunæ of different regions.

A specimen of "Medina Sandstone," containing *Lingula cuneata*, from Rochester Creek, Niagara, in the Geological Society's Museum, contains several coarse sandy casts of a *Leperditia* (subgenus *Isochilina*), occasionally  $\frac{1}{4}$  inch long and  $\frac{3}{20}$  inch broad, resembling the specimens from Russia figured in Annals Nat. Hist. 2 ser. vol. xvii. pl. 7. figs. 11 & 12, which were referred with considerable doubt\* to *L. marginata* of Keyserling, and are most probably of the same species as those figured by Eichwald† under the name of "*Cypridina Balthica*."

It is easy to find on the piece of sandstone before me imperfect or partially imbedded specimens more or less resembling the figures given by Prof. Hall; and, should they prove to be the same as his, I shall be inclined to apply his name of "*cylindrica*" to "the smaller form of *L. marginata* ‡"; and, as I have already suggested its independence of the large *L. marginata*, being itself probably an adult form, and that it would belong, in that case, to a subgenus of *Leperditia*, I feel little hesitation in grouping it with the *Isochilina* described above § (p. 248).

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(*Beechey Island : additional.*)

5. *Cytheropsis concinna*? Pl. IX. fig. 3.

Length  $\frac{1}{22}$ , breadth  $\frac{1}{37}$  inch.

Oblong-ovate, somewhat *Leperditia*-shaped; ends unequal, ventral edge well rounded; surface smooth.

This very much resembles *C. concinna* (above, p. 249).

Several specimens occur in the limestone from Beechey Island.

The following Table exhibits a general view of the genera and their species as yet known in Arctic America, Canada, and the States.

\* *Op. cit.* p. 91. There is an important error to be corrected in the page here referred to: at line 7 from bottom for fig. 6 read figs. 7 & 8.

† *Bullet. Imp. Soc. Moscou*, 1854, no. 1. p. 99. pl. 2. figs. 7 & 8. "*C. Baltica*" and "*C. minuta*" are also quoted by Capt. P. Jeremejew, as occurring at Iswos, &c. *Verhandl. R.-K. Min. Ges.* 1856, p. 83.

‡ *Op. cit.* p. 94.

§ In connexion with the Russian specimens above alluded to, M. Eichwald mentions a form having a row of punctiform pits on the border of the valve (*Annals, loc. cit.* p. 93). This is an important feature also in the *Isochilina* above described from Canada (see p. 248).

	Localities.	Prof. Hall's groups.	Prof. Rogers's groups.	British groups.
1. <i>Beyrichia rugulifera, Jones</i> .....	} Beechey Island .....			} Wenlock group.
2. — <i>sigillata, Jones</i> .....				
3. — <i>clathrata, Jones</i> .....				
4. — <i>plagosa, Jones</i> .....				
5. <i>Leperditia gibbera, Jones</i> .....				
6. — <i>Arctica, Jones</i> .....				
7. — <i>marginata, Keyserling</i> .....				
8. — <i>alta, Conrad</i> .....	Wellington Straits.....	} Coralline Limestone and Tentaculite Limestone (Lower Helderberg) .....	} Premieridian	} Wenlock group.
5a. — <i>gibbera, var. scalaris</i> .....	Rupert's Land (and Petschora Land) .....			
9. <i>Beyrichia Maccoyiana, Jones</i> .....	Schoharie (and Wellington Straits).....			
10. — <i>Pennsylvanica, Jones</i> .....	Williamsville and Pennsylvania .....			
11. <i>Leperditia Pennsylvanica, Jones</i> .....	Pennsylvania .....			
12. <i>Beyrichia lata, Vanuxem</i> .....	Pennsylvania .....			
13. <i>Isochilina cylindrica (?) , Hall</i> .....	Oneida County, &c. ....			
14. <i>Leperditia fabulites, Conrad</i> .....	Medina, &c. ....			
15. <i>Cytheropsis concinna, Jones</i> .....	Wisconsin .....			
16. — <i>Siliqua, Jones</i> .....	} Allumette Island, Ottawa .....			
17. — <i>rugosa, Jones</i> .....				
20a. <i>Leperditia Canadensis (large var.)</i> .....				
18. — <i>ovata, Jones</i> .....	Pennsylvania .....	} Blackriver Limestone .....	} Auroral .....	} Llandovery and Caradoc groups.
20a. — <i>Canadensis (large var.)</i> .....	Louck's Mill, Canada .....			
19. <i>Isochilina gracilis, Jones</i> .....	Isle Jesus, Canada.....	} Birdseye Limestone .....	} Primal .....	
20. <i>Leperditia Canadensis, Jones</i> .....	Grande Isle, Grenville, and Hawkesbury .....			
21. <i>Beyrichia Logan, Jones</i> .....	Grenville and Hawkesbury .....			
22. <i>Isochilina Ottawa, Jones</i> .....	Grenville, Canada .....	} Calciferous Sandrock .....		
23. <i>Leperditia Anna, Jones</i> .....	St Ann, Canada .....			

Two other forms of Entomostraca, with which I am as yet unacquainted, are described by Prof. J. Hall; namely "*Cytherina spinosa*," Pal. N. York, vol. ii. p. 317. pl. 67. f. 17-21, and "*Beyrichia symmetrica*," *loc. cit.* f. 16, from the Niagara Shale, Lockport. Hall also mentions and figures another form (*op. cit.* vol. i. p. 44. pl. 10. f. 12) from the Birdseye Limestone and Trenton Limestone.

## EXPLANATION OF THE PLATES.

## PLATE IX.

[From Beechey Island. In the Museum of the Geological Survey of Great Britain.]

- Fig. 1. *Beyrichia clathrata*; left valve: *a*, magnified 4 times; *b*, magnified 24 times.  
 Fig. 2. *B. plagosa*; left valve: *a*, magnified 4 times; *b*, magnified 24 times.  
 Fig. 3. *Cytheropsis concinna* (?); right valve: *a*, magnified 4 times; *b*, magnified 24 times.  
 Fig. 4. *B. rugulifera*; right valve: *a*, magnified 4 times; *b*, magnified 24 times; *c*, portion of surface of *b*, magnified 75 diameters.  
 Fig. 5. *B. sigillata*; left valve: *a*, magnified 4 times; *b*, magnified 24 times.

[From Canada. In the Museum of the Geological Survey of Canada.]

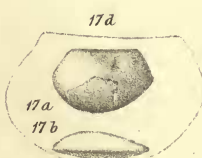
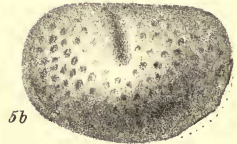
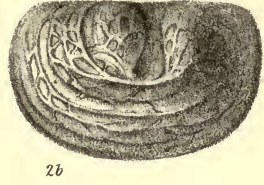
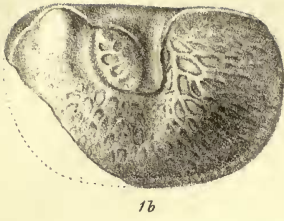
- Fig. 6. *B. Logani* (var. *reniformis*); magnified 4 times: *a*, right valve; *b*, dorsal view; *c*, anterior view. From Hawkesbury.  
 Fig. 7. *B. Logani*; magnified 4 times: *a*, left valve; *b*, dorsal, and *c*, posterior view. From Hawkesbury.  
 Fig. 8. *B. Logani*; magnified 4 times: *a*, left valve; *b*, ventral, and *c*, posterior view. From Grenville.  
 Fig. 9. *B. Logani*; magnified 4 times: *a*, right valve; *b*, dorsal view. From Hawkesbury.  
 Fig. 10. *B. Logani* (var. *leperditiioides*); magnified 4 times: *a*, right valve; *b*, anterior view. From Grenville.  
 Fig. 11. *Leperditia Canadensis*; magnified 4 times: *a*, left valve; *b*, ventral, and *c*, posterior view. From Grenville.  
 Fig. 12. *L. Canadensis*; magnified 4 times: *a*, right valve; *b*, ventral view. From Grenville.  
 Fig. 13. *L. Canadensis* (var. *labrosa*); magnified 4 times: *a*, left valve; *b*, ventral, and *c*, anterior view; *d*, portion of surface of *a*, very highly magnified ( $\times 75$ ).  
 Fig. 14. *L. Canadensis*; magnified 4 times: *a*, left valve; *b*, dorsal, and *c*, anterior view. From Grande Isle.  
 Fig. 15. *L. Canadensis*; dorsal view of the united valves (nearly closed); magnified 4 times. From Grande Isle.  
 Fig. 16. *L. Canadensis* (large variety): *a*, right valve, magnified 2 diameters; *b*, ventral view; *c*, anterior view; *d*, outline, magnified 4 times. From Louck's Mill.  
 Fig. 17. *L. Canadensis* (large var.): *a*, right valve, magnified 2 diameters; *b*, the ventral, and *c*, the anterior view, showing the inner flange of the ventral edge; *d*, outline, magnified 4 times. From Pauquette's Rapids.  
 Fig. 18. *L. Anna*; magnified 4 times: *a*, right valve; *b*, ventral, and *c*, anterior view; *d*, portion of surface of *a*, highly magnified ( $\times 25$ ). From St. Anne's.

## PLATE X.

[In the Museum of the Geological Survey of Canada.]

- Fig. 1. *Isochilina Ottawa*; magnified 4 times: *a*, left valve; *b*, anterior, and *c*, ventral view. From Grenville Canal.





T.R.J. del. G. West lith.

W. West imp.